Modeling polarization of light from heavy aerosols over oceans

Wenbo Sun[a,*], Bruce A. Wielicki[b], Yolanda Shea[b], Constantine Lukashin[b], and Gary Fleming[b]

[a]*Science Systems and Applications Inc, Hampton, VA 23666, USA*
[b]*NASA Langley Research Center, Hampton, VA 23681, USA*

[*]*Presenting author (wenbo.sun-1@nasa.gov)*

Reflected solar radiation from the Earth's ocean-atmosphere system is polarized by earth surface and atmospheric molecules and particles [1]. If a non-polarimetric radiometric sensor is sensitive to polarization, then this can be a source of measurement errors in satellite remote sensing. To correct the errors due to this effect, the polarization state of the reflected solar light must be known. A study of the sensitivity of reflected solar radiation's polarization to heavy aerosols over oceans is done with the adding-doubling radiative-transfer model [1]. We found that the polarization of light is sensitive to aerosol type when aerosol optical depth (AOD) is large. We also found that nonspherical aerosol particles can monotonically increase the backscatter polarization degree with the increase of AOD. This gives us a simple method to detect AOD over oceans. By comparing the angle of linear polarization of heavy aerosol loadings over the ocean from PARASOL data, models, and both PARASOL and model results for cloudy oceans [2,3], we found that PARASOL aerosol products have serious cloud contamination. This study shows the necessity of including aerosol types in the CLARREO Pathfinder [4] polarization distribution model.

References

[1] Sun, W., and C. Lukashin, 2013: Modeling polarized solar radiation from ocean-atmosphere system for CLARREO inter-calibration applications. *Atmos. Chem. Phys*. **13**, 10303–10324.
[2] Sun, W., G. Videen, and M. I. Mishchenko, 2014: Detecting super-thin clouds with polarized sunlight. *Geophy. Res. Lett.* **41**, 688–693.
[3] Sun, W., R. R. Baize, G. Videen, Y. Hu, and Q. Fu, 2015: A method to retrieve super-thin cloud optical depth over ocean background with polarized sunlight. *Atmos. Chem. Phys*. **15**, 11909–11918.
[4] Wielicki, B. A., D. F. Young, M. G. Mlynczak, *et al*., 2013: Achieving climate change absolute accuracy in orbit. *Bull. Am. Meteorol. Soc.* **94**, 1520–1539.

Preferred mode of presentation: Oral/Poster